UNITED NATIONS

GENERAL ASSEMBLY

Distr.
GENERAL

A/AC.105/567
21 December 1993

ENGLISH
ORIGINAL: CHINESE/ENGLISH/
SPANISH

COMMITTEE ON THE PEACEFUL
USES OF OUTER SPACE
Scientific and Technical Subcommittee
Thirty-first session
Vienna, 21 February-4 March 1994
Item 5 of the provisional agenda*

# IMPLEMENTATION OF THE RECOMMENDATIONS OF THE SECOND UNITED NATIONS CONFERENCE ON THE EXPLORATION AND PEACEFUL USES OF OUTER SPACE

## International cooperation in the peaceful uses of outer space: activities of Member States

Note by the Secretariat

CONTENTS

| | Page |
|---|---|
| INTRODUCTION | 2 |
| REPLIES RECEIVED FROM MEMBER STATES | 3 |
| China | 3 |
| Cuba | 9 |
| Italy | 9 |
| Poland | 14 |
| Portugal | 20 |
| South Africa | 22 |
| Turkey | 24 |
| Ukraine | 26 |

*A/AC.105/C.1/L.190.

V.93-91268T

## INTRODUCTION

1. The Working Group of the Whole to Evaluate the Implementation of the Recommendations of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE 82), in the report on the work of its sixth session (A/AC.105/543, annex II), made recommendations concerning the preparation of reports and studies by the Secretariat and the compilation of information from Member States.

2. In paragraph 10 of its report, the Working Group recommended that, in the light of the continued development and evolution of space activities, the Committee on the Peaceful Uses of Outer Space should request all States, particularly those with major space or space-related capabilities, to continue to inform the Secretary-General annually, as appropriate, about those space activities that were or could be the subject of greater international cooperation, with particular emphasis on the needs of the developing countries.

3. The report of the Working Group was adopted by the Scientific and Technical Subcommittee at its thirtieth session (A/AC.105/543, para. 22), and the recommendations of the Working Group were endorsed by the Committee on the Peaceful Uses of Outer Space at its thirty-sixth session. 1/

4. Subsequently, in a note verbale dated 10 September 1993 from the Secretary-General to all permanent representatives to the United Nations, the Secretary-General requested all Governments to communicate to the Secretariat, by 31 October 1993, the information requested in the above-mentioned recommendations.

5. In addition, the Secretary-General, in his note verbale, drew the attention of Governments to the following recommendation of the Committee:

> "The Committee recommended that the Secretariat should invite Member States to submit annual reports on their space activities. In addition to information on national and international space programmes, the reports could include information in response to requests from the Working Group of the Whole as well as information on spin-off benefits of space activities and other topics as requested by the Committee and its subsidiary bodies." 2/

6. In accordance with the recommendation of the Committee, the Secretary-General, in his note verbale, suggested that Governments could submit in a single report on national space activities information in response to those requests, as well as information on topics as requested by the Working Group, in particular information on the following topics:

(a) Those space activities that were or could be the subject of greater international cooperation, with particular emphasis on the needs of the developing countries;
(b) Spin-off benefits of space activities;
(c) National and international research concerning the safety of nuclear-powered satellites;
(d) Studies conducted on the problem of the collision of nuclear power sources with space debris;
(e) National research on space debris.

7. The present document was prepared by the Secretariat on the basis of information on the topics listed in subparagraphs 6 (a) and (b) above, received from Member States as of 15 December 1993. Information received subsequent to that date will be included in addenda to the present document. Information received regarding the topics listed in subparagraphs 6 (c)-(e) above is presented in a separate document (A/AC.105/565).

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1/ Official Records of the General Assembly, Forty-eighth Session, Supplement No. 20 (A/48/20), para. 25.

2/ Ibid., para. 122.

## REPLIES RECEIVED FROM MEMBER STATES*

## CHINA

[Original: Chinese]

### ANNUAL REPORT ON CHINA'S ACTIVITIES IN SPACE (1992-1993), October 1993

Space technology and its application are one of the priority areas of the Chinese Government and have been included in the national programme for scientific and technological development as well as the plan for high-tech development. At present, China is devoting itself to the development and extensive application of communications satellites, meteorological satellites, resources satellites, re-entry remote sensing satellites, scientific experimental satellites and other application satellites, in order to move forward China's economic construction and social development.

During the reporting year from 1992 to 1993, China was actively engaged in space activities, successfully launching some satellites and space probes, encouraging applied research, organizing a series of international activities, and developing a number of international cooperation projects.

### I. SATELLITE APPLICATIONS

#### 1. APPLICATIONS OF REMOTE SENSING TECHNOLOGY AND GEOGRAPHICAL INFORMATION SYSTEMS (GIS)

China successfully launched and retrieved 14 re-entry satellites, as a result of which a large amount of information was obtained, and effective studies conducted in national land surveys, environmental monitoring, urban planning, etc.

(i) *Using remote sensing technology to estimate the output of agricultural crops.* This was included as a key project in national science and technology research. As far as the rice-growing areas in Hubei Province, wheat-growing areas in Henan Province and maize-growing areas in the North-Eastern Plain were concerned, work was completed on field surveys, information collection, graphics processing and analysis and development of output-estimating models.

(ii) *Using remote sensing technology to monitor natural disasters.* This includes: conducting seismic prediction by reading abnormal thermal infrared images from satellites, complemented also by other means; monitoring forest fires through meteorological satellites; carrying out nationwide surveys on soil erosion by using remote sensing technology together with other techniques, so that the extent of nationwide soil erosion can be reflected on maps and in statistical data, and on this basis a status map on soil erosion in China (scale: 1 : 2,500,000) was drawn, which provided first-hand information for agricultural and environmental protection.

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*The replies are reproduced in the form in which they were received.

(iii) *Remote sensing surveys and dynamic monitoring of China's pasture resources.* This was conducted on the grassland in Inner Mongolia.

(iv) Establishing an *aeronautical remote-sensing real-time transmitting system* for monitoring natural disasters. This system is able to obtain pictures of disaster-stricken areas through on-satellite synthetic-aperture radar (SAR). The condensed pictures are then retransmitted through the satellite to a ground control centre and sent to disaster-relief departments for their information and for them to take appropriate measures to mitigate the losses in affected areas.

(v) *Dynamic monitoring of the maritime environment.* In the Bohai Sea waters, monitoring work was conducted on oil pollution and offshore industrial waste water pollution.

(vi) *Setting up remote sensing systems and GISs in some major cities.* The preparatory work was under way in some large and medium-sized cities, such as Beijing, Shanghai and Shenzheng, and the city of Fuzhou was elected as a place for carrying out pilot land measurements.

## 2. APPLICATIONS OF COMMUNICATIONS SATELLITES

The Chinese Government stepped up its efforts to develop the Dongfanghong-3 communications satellite, which would be equipped with 24 transponders, of which eight would be used for television, and the remaining 16 for telecommunications.

China also purchased from the United States of America an in-orbit communications satellite which had transponders with 22 C-bands and six Ku-bands. This satellite was put into operation in August 1993.

The satellite television network was broadcasting 10 television programmes and 30 radio programmes. Nationwide, there were about 40,000 television receiving stations with 3- to 6-metre antennas, and 100,000 home television receiving units. The long-distance educational system which China had established using satellite television provided two sets of educational programmes, totalling 30 hours a day. China had nearly 5,000 receiving stations for satellite educational television programmes and about 5,000 stations for educational video shows. The number of viewers exceeded 10 million.

The VSAT (Very Small Aperture Antenna) system was widely used in China: about 500 two-way VSAT stations and over 1,000 one-way stations were set up and put into operation across the country, and their numbers were increasing rather quickly. The VSAT is an integrated system which can combine the functions of transmitting voice and data, providing electronic mail, and permitting meetings to be held using picture and voice transmission.

Great importance was attached to the development of mobile communications technology in China, which now had about 10 complete mobile satellite ground stations equipped either with a 2.4-metre antenna and Ku-bands or a 7.2-metre antenna and C-bands for the purposes of live televised coverage and emergency communications.

## II. RESEARCH ACTIVITIES IN SPACE

### 1. EXPERIMENTS UNDER MICROGRAVITY CONDITIONS IN SPACE

An experiment on the growth of protein crystals was carried out in a re-entry satellite sent into space in August 1992, which carried 10 kinds of protein in 48 test tubes. In outer space out of six kinds of protein in 24 of the tubes, crystals grew, which could be used for analyses and tests. On-satellite experiments on the crystallization of tellurium, cadmium and mercury were also carried out and achieved satisfactory results.

On the satellite launched in October 1992, a total of 45 experiments were conducted under microgravity conditions, involving animals, plants, genetic micro-organisms, physics and other disciplines. To assist high school students in their experiments, the satellite also carried several kilograms of tomato seeds.

On the re-entry scientific experimental satellite launched in October 1993, a satellite positioner was installed and various experiments were carried out, such as a space materials science study and a genetic study of plant seeds on board.

### 2. HIGH-ALTITUDE BALLOON PROBES

Between August and September 1993, China conducted seven experiments with high-altitude scientific experimental balloons, volumes of which were 30,000, 50,000 and 200,000 cubic metres respectively. Their main research items included a gasoloid test, ozonospheric probing, experiments with a microgravity landing module, laser atmospheric measurement, and exploration of X-rays from CVJ-X3 cosmic sources, etc.

### 3. ROCKET PROBES

China built a low-latitude rocket probe launching site and developed two kinds of rocket probes. One of them was Zhinui-2, which was 63 kg in total weight, had a 4.8-kg payload and about a 70-km maximum flying altitude. Zhinui-3, whose maximum flying altitude reached 147 km, had a total weight of 282 kg and a 25-kg payload. Both were used for probing irregular changes in the low-latitude ionosphere and obtaining high atmospheric parameters.

## III. SATELLITE LAUNCHING

In 1992, China made fairly substantial progress in the development of its space technology. A new type of re-entry satellite was sent into space on the LM-2D launch rocket at the Jiouquan satellite launching centre on 9 August 1992. The satellite successfully returned to earth after 16 days in orbit.

At the satellite launching centre in Xichang, an Australian communications satellite (AUSSAT-B1), which had an effective payload of 7.66 tons, together with the attached rocket stage, was sent into orbit at a perigee height of 200 km and an apogee height of 1,050 km, on the Long March-2 launch rocket (LM-2E), on 14 August 1992.

At the Jiouquan satellite launching centre, China's fourteenth re-entry satellite and a Swedish scientific experimental satellite (FREJA) were successfully put into orbit on the Long March-2 launch rocket (LM-2C) on 6 October 1992. The Chinese satellite returned to earth as scheduled, and the Swedish satellite entered the prescribed orbit.

At the satellite launching centre in Xichang, another Australian satellite (AUSSAT-B2) and the attached rocket stage were sent into the prescribed orbit by the Long March-2 launch rocket (LM-2E) on 21 December 1992, and were placed in the orbital position required under the contract.

At the Jiouquan satellite launching centre, China's fifteenth re-entry satellite was launched on the Long March-2 launch rocket (LM-2C) on 8 October 1993, but its re-entry module was not retrieved as scheduled due to technical problems.

In addition, between 1993 and 1994, China is planning to launch four or five application satellites, including a new generation of re-entry satellites for scientific experimentation and technological probing, a medium-capacity communications and broadcasting satellite (Dongfanghong-3), the Shijian-4 scientific experimental satellite and a geosynchronous meteorological satellite (FY-2). China's FY-2 meteorological satellite is equipped with a multi-channel scanning radiometer and other sensors, through which images of visible light, water and vapour can be obtained, and simultaneous data on the monitoring of the outer space environment can be collected and retransmitted. Its successful launch will make it possible to provide meteorological and remote sensing information to many countries in the world.

## IV. INTERNATIONAL COOPERATION IN SPACE ACTIVITIES

### 1. INTERNATIONAL COOPERATION AND EXCHANGES

A working meeting of the Committee of Geoscience and Geotechnology Experts for the International Space Year was held in Beijing on 29 January 1992, with the participation of 19 officials and experts responsible for observation of the International Space Year from Europe, the United States of America and some important Asia-Pacific countries as well as 38 Chinese experts.

From 11 to 14 October 1992, the Chinese Society of Astronautics and the International Academy of Astronautics (IAA) organized the International Seminar on the Economic Efficiency of Space Activities in Beijing. More than 100 representatives from Germany, France, Japan, Belgium, the Netherlands, India, Russia, China and other countries attended the seminar and discussed the question of economic efficiency of space activities in four areas, such as earth observation, communications and broadcasting technology and system operation management.

From 26 to 30 October 1992, an international seminar on global environmental changes was held in Beijing under the joint sponsorship of the European Community and the Chinese Government. The seminar, which was attended by 19 representatives from Europe and 38 Chinese representatives, was devoted mainly to exchanging views and

experiences on such questions as the uses of space technology in monitoring global environmental changes as well as the maritime atmospheric interaction.

From 30 November to 5 December 1992, China, Thailand and Pakistan jointly sponsored the Asia-Pacific Workshop on Multilateral Cooperation in Space Technology and Applications in Beijing, China, which was attended by more than 100 high-level officials and technical experts from 23 countries and territories in the Asia-Pacific region as well as officials of the Committee on the Peaceful Uses of Outer Space. The participants reached a common understanding on the principles to be followed in space activities cooperation in the Asia-Pacific region and on the possibilities and modalities for, and ways to carry out, such cooperation. In 1993, relevant discussions were organized, the establishment of an information centre was encouraged and actively prepared in order to consolidate limited information resources in the region, and multilateral cooperation projects were undertaken in such areas as microgravity experiments, small satellite technology and remote-sensing satellite technology and its applications. The Chinese Government attached great importance to these two seminars and indicated its willingness to increase its contribution to multilateral cooperation in space technology and its applications in the Asia-Pacific region.

In April 1993, the twenty-first session of the International Coordination Organization of Geostationary Meteorological Satellites was held in Beijing. Its participants visited the satellite launching site in Xichang, Sichuan Province, during the session.

At an international seminar on the research of microgravity held in Beijing in May 1993, representatives from Germany, Japan, China and other countries held discussions on the development and application of microgravity science as well as related aspects.

At the Third International Seminar on Geographic Information Systems held in Beijing on 18 August 1983, 80 representatives from 24 countries and territories shared views and held discussions on the development and application of remote sensing and geographic information systems technology as well as international cooperation in this field.

A seminar on the application of microwave remote sensing will be held in Beijing in April 1994, sponsored by the United Nations Office For Outer Space Affairs and the Chinese Government. The seminar is to be attended by 20 representatives from developing countries, for whose accommodation the Chinese Government will provide financial assistance, 15 representatives from developed countries and 35 Chinese representatives. The subject of the seminar is the development and application of microwave remote sensing technology, especially synthetic aperture radar (SAR).

A ministerial meeting on promotion and development of space applications in the Asia-Pacific region, jointly sponsored by the Economic and Social Commission for Asia and the Pacific (ESCAP) and the Chinese Government, is scheduled to take place in Beijing from 19 to 28 September 1994. The meeting, which is expected to be attended by more than 50 ministers and 200 representatives, will discuss such questions as space applications and technical cooperation. Along with the meeting, an exhibition on the application of space technology will be held and expert discussions organized.

In March 1993, China became a formal member of the Committee on Space Research (COSPAR) of the International Council of Scientific Unions, and in August of the same year, the corresponding Chinese COSPAR Committee was founded.

At the meeting of the Committee on Earth Observation Satellites (CEOS) held in London in December 1992, China submitted its application for membership in the Committee, and in March 1993 China was accepted and became a formal member of CEOS.

From 16 to 19 October 1993, a Chinese astronautical delegation, headed by Director Liu Jiyun of the State Bureau of Astronautics, attended the forty-fourth session of the General Assembly of the International Astronautical Federation (IAF) held in Austria. The session decided that the forty-seventh session of the IAF General Assembly will be held in Beijing.

## 2. Cooperation with other countries in space applications

*Sino-Japanese cooperation in remote sensing space applications.* This included remote sensing monitoring of the environment, using the data from the Japanese Earth Resources Satellite (JERS-1). Panyang Lake in China's Jiangxi Province was selected as an experimental site.

*Sino-European Community (EC) cooperation in using remote sensing technology to monitor the spontaneous combustion of a coal bed in northern China.* This included determining the range and extent of spontaneous combustion as well as its impact on the surrounding atmosphere.

*Sino-Australian cooperation in the application of remote sensing technology to monitoring soil humidity.* This included using remote sensing technology to conduct drought prediction in order to provide a scientific basis for agricultural production.

*Sino-Thai cooperation in using remote sensing technology and GIS to monitor small area soil erosion.* Chiang Rai in northern Thailand and Xichang County in China's eastern Zhejiang Province were selected for evaluations that would facilitate local environmental conservation.

*Sino-Italian cooperation in using remote sensing technology and GIS in urban development.* This included the establishment of GIS data banks for urban areas using remote sensing technology. China's Fuzhou City was selected as the pilot city for this project.

*Sino-Brazilian joint project for the development of an earth resources remote-sensing satellite (CBERS).* The project design was completed and various items of equipment were being developed and tested. The Governments of the two countries will continue to strongly support and promote this project.

Part of China's astronautical remote sensing monitoring system for disaster relief was developed in cooperation with Canada, Australia and some other countries.

In the fields of space exploration and space technology, China also had quite a number of contacts with Russia and the United States of America and cooperated with them in some individual technologies.

## CUBA

[Original: Spanish]

The Government of the Republic of Cuba states that at present it is not conducting any research relating to space debris, although it is following closely and with great attention all developments in this important matter, which also has an impact on Cuba's environment.

The Government of the Republic of Cuba is fully prepared to collaborate with the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space, both on this subject and on any others of mutual interest.

In addition, Cuba is actively engaged in the preparation of the material necessary to ensure effective participation by the Cuban delegation at the next meetings of the Scientific and Technical Subcommittee which will be held in Vienna from 21 February to 4 March 1994.

## ITALY

[Original: English]

### 1993 SPACE ACTIVITIES

### INTRODUCTION

Italy began to develop its space activities in the 1960's with its participation in European programs, namely ESRO, ELDO, and ESA, as well as domestic programs, namely the SIRIO industrial project and the University of Rome's SAN MARCO project.

During the 1980's there was a leap in the quality of space activities, characterized by a qualified Italian presence in ESA, and by a national five-year program. This program has favored a rapid development of the scientific and industrial structures, adapting them to the world market and making them more competitive with the main European partners. It has also enhanced a strong, strategic collaboration with NASA on a joint basis.

The first phase of the program, which began in 1980 with the first five-year project, concluded with the recognition of Italy's role in ESA at the last Ministerial Conferences in Monaco and Granada.

TELECOMMUNICATIONS PROGRAMS

In the field of telecommunications, the premises for Italy's qualification in advanced systems were laid with the launching of the SIRIO satellite in 1977.

However, Italy took on an important European role with its successful preoperative satellite for telecommunications ITALSAT F1 and its participation in ESA's telecommunications programs.

Domestic Activities:

Italy is continuing its commitment to realizing ITALSAT F2, as well as to other high technology activities.

In the field of telecommunications, 7.751 million lira were provided for activities related to building ITALSAT 2 and to managing the functioning of ITALSAT 1.

ESA Activities:

Italian idustry has a leadership position in the DRTM (Data Relay and Technology Mission) with the construction of two elements, DRS and ARTEMIS, with a participation equivalent to 45% for the first and 40% for the second.

Italy is significantly involved in other programs for the technological support and development of telecommunications, including the PSDE 2 TM program.

In 1993, Italy's total participation in ESA telecommunications' programs amounted to 115.5 billion lira, equivalent to 16.0% of ESA's entire contribution.

SPACE TRANSPORTATION

In the field of space transportation, Italy's capacity increased in the area of solid propellant motors with the Ariane 5 booster and the development of the IRIS system, which qualified for the Shuttle when the LAGEOS II satellite was sent into orbit in 1992.

Along the same lines Italy is developing a small-satellite launcher, derived from the original San Marco Scout project.

Domestic Activities:

In 1993 Italy earmarked 60.000 million lira for the small-satellite launcher, in correspondence with a protocol between the Italian Space Agency and the University of Rome.

The IRIS system of space transfer, an Italian concept, receives a financial commitment equivalent ot 467 million lira.

The CARINA vehicle is also being planned, and it will allow in-orbit microgravity experiments on the sciences of fluids, of materials, and of life, with the possibility of recovering the testing equipment.

ESA Activities:

The main ESA programs in this sector are ARIANE 5 and the HERMES program. For Ariane 5, Italian industry is heavily involved in the propulsion part, with a domestic participation of 15%, equivalent to 195 billion lira.

The Hermes program underwent significant modifications at the last Ministerial Conference on ESA, and a part of its funds was transferred to cooperation with Russia. However, Italy's interests are still high, and it has confirmed its 12.10% participation, equivalent to 42.5 million lira.

SCIENTIFIC SATELLITES

Domestic Activities:

On July 31, 1992, the TSS-1 (Tethered Satellite System) was launched with the STS Atlantis Shuttle Flight.

In October 1992 the geodetic satellite LAGEOS II, installed on board the IRIS, was sent into orbit. This mission represented a milestone for Italy/s space geodesy programs.

Currently, the SAX (Astronomic Satellite for X-ray), for the study of galactic and extra-galactic X-rays sources, is in the development and construction stage. The SAX satellite was built under the auspices of international collaboration, with ASI/NIVR (Holland).

ESA Activities:

Italy participates in HORIZON 200, ESA's required scientific program, with a 16.36% share, equivalent to 73 billion lira.

The programs it is currently implementing include the STSP, the XMM, and the ISO (Infra-Red Space Observatory) satellite.

ESA's scientific activities also include two optional programs: the EURECA program, and the Microgravity program.

Italy's total contribution to ESA's sceintific activities, including basic research activities, amounts to a total of 112 billion lira.

ORBITAL INFRASTRUCTURES

Domestic Activities:

The 1990-1994 Domestic Space Plan emphasizes the importance of this sector for the future of manned space activities in space.

Starting in September 1991, a Memorandum of Agreement was signed between the Italian Space Agency and NASA for the construction of two pressurized logistic modules and a minilaboratory for the Space Station Freedom. Activities in this direction are continuing without interruption.

As far as the Space Automation and the Robotics Program is concerned, Italy industry has committed to building a manipulating arm for SPIDER (Space Inspection Device for Extravehicular Repairs).

ESA Activities:

Through ESA, Italy participates in the Columbus (Columbus Attached Laboratory) Program, which is connected to the Space Station Freedom, with a total 1993 share of 17.9%, equivalent to 127.7 billion lira.

The program is quite important to Italian industry, which participates in the realization of the four elements in which the program is subdivided: the European pressurized module, the polar platform, precursory flights, and studies for the space station in cooperation with Russia.

OBSERVATIONS OF THE EARTH

Domestic Activities:

In the area of the TeleSurvey Programs, various activities are underway that have already begun within the framework of important international collaboration initiatives.

Within the framework of the ASI/DARA agreement (Germany), activities are currently being completed that are related to the space segment and to the earth segment for the construction of an active microwave sensor to install on board the Shuttle.

Within the framework of the ASE/ESA agreement, in Matera there is an operating PAF system for treating the storing and distribution of images obtained from the ERS-1 satellite.

Within the framework of the ASI/CNES agreement (France), the IASI (Interferometric Atmosphere Sound Infra-Red) program is in the development stage.

Within the framework of ASI/NASA collaboration (USA), an agreement is being developed for the CASSINI interplanetary mission, dedicated to the study of the Saturn system.

Within the framework of Spatial Geodesy, the HIPPOS program for the development of a high-precision positioning service is currently being implemented.

ESA Activities:

Italy participates through ESA in the POEM-1 mission, subdivided into the study of the environment (ENVISAT) and the study of climate (METEOP).

Other activities regard the operative stage of the ERS-1 and ERS-2 satellites, that together cover 60% of the resources dedicated to observations of the Earth.

Italy's average total participation in Earth Observation Programs is 11.5%, equivalent to approximately 48.5 billion lira.

BASIC RESEARCH

Fifteen percent of the annual resources provided for by the National Space Plan are targeted for research.

This year research proposals were incorporated into the following areas:

Optics and Astronomy; High-Energy Astrophysics; Infra-Red Astronomy; Physics of Interplanetary Space; Planetology; Basic Physics; Space Biology and Medicine; Microgravity; Physics of the Atmosphere; Spatial Geophysics and Geodesy; Space systems; Aerothermodynamics; Telecommunications; Telesurveying.

STUDIES AND TECHNOLOGY

Study activities and the development of new technologies are considered indispensable for the definition of new programs and for the promotion of new capacities for domestic industry.

For 1993, approximately 40.000 million lira has been earmarked for these activities.

Italy's participation in ESA's technology development programs contributes decisively to the acquisition of industrial capacity.

Participation in technology developemnt programs in the area of Telecommunications has been particularly significant.

In sum, Italy's contribution to ESA's technology programs amounts to approximately 33.000 million lira, equivalent to 4.6% of total participation.

POLAND

[Original: English]

# INFORMATION ON SPACE ACTIVITIES IN POLAND IN 1993

Committee on Space Research of the Polish Academy of Sciences coordinates the activity of the number of institutions in Poland in the field of space research and applications. This activity is connected to international programs and bilateral agreements of Poland and other countries.

This report presents some results of space activity in Poland in the field of space physics, satellite geodesy, remote sensing and space biology and medicine.

## I. SPACE PHYSICS

Polish activities in this field have been concentrated in the following directions:

- participation in space missions,
- design and construction of scientific equipment for experiments in space physics,
- processing and interpretation of data obtained from previous and current space experiments,

### SPACE MISSIONS

Currently space physicists in Poland have been participating in the international space project APEX (launched from a Russian cosmodrom on 16 December 1991, still orbiting). It is devoted to study the ionospheric plasma and its interactions with beams of high-energy electrons. Six Polish instruments, aimed to measure spectral features of plasma waves artificially stimulated from the spacecraft, work satisfactory.

Analysis of their data is currently under way. Wave field disturbances have been recorded aboard the sub-satellite after particle injections from the main satellite, a few tens kilometers distant.

### HARDWARE FOR FUTURE EXPERIMENTS

Development of instrumentation for several international projects coordinated by the Space Research Institute in Russia, is being under way in Poland.

Below is the list of Polish contribution to these projects:

- radio frequency spectrum analyzers to study wave generation and propagation in ionosphere and magnetosphere for two international projects:

INTERBALL and MARS-94, to be launched in 1994,

- Solar X-ray photometers and spectrometers for INTERBALL, CORONAS-I and CORONAS-F,

- detector of high-energy neutral particles scheduled for RELICT-2 mission,

- infrared planetary Fourier Spectrometer for MARS-94 mission.

DATA PROCESSING AND INTERPRETATION

Polish contribution to processing and analysis of space data is listed below:

- processing and interpretation of data from AKTYVNY and APEX missions,

- participation in data interpretation of 2 - 3 kHz emissions recorded by the plasma wave instrument in deep space Voyager mission,

- usage of data from VEGA-2 mission for studies of dust particles around the comet Halley,

- usage of X-ray data from Solar Maximum Mission for investigations of flare heating, plasma motions in flares and chemical composition of flare plasma.

New results of theoretical analysis of particle trajectories in the magneto-tail of the Earth indicate that in the presence of convection electric field (as typical for the northward interplanetary magnetic field) the plasma mantle particles have no access to the neutral sheet in the dawn sector of the tail. It explains some of earlier published PROGNOZ-8 observations of dense and cold plasma appearance in the near tail.

CENTRES OF ACTIVITIES IN SPACE PHYSICS

Most of activities in space physics is concentrated in Space Research Centre in Warsaw and in its branch, Solar Physics Division, in Wroclaw. Some works in experimental studies of the magnetospheric radio emissions are also carried out in Torun Laboratory of Astrophysics of the Copernicus Astronomical Centre.

## II. SATELLITE GEODESY

Report on satellite geodesy for the period 1993 presents the following topics reflecting the geodetic activity in Poland:

1. International Geodynamic GPS Service (IGS) activity in Poland,
2. Baltic Sea Level Project activity,

3. SAGET and EXTENDED SAGET projects,
4. Final solution of the EUREF-POL network,
5. Laser activity at Borowiec station,
6. Satellite altimetry.

1. Three Polish stations set up permanent GPS observations: Borowiec Station of the Space Research Centre of the Polish Academy of Sciences, Józefoslaw of the Warsaw University of Technology and Lamkówko of the Academy of Agriculture in Olsztyn. At Borowiec and Lamkówko, Turbo Rogue receivers were installed in September 1993 and will be fully operational in 1994. In Józefoslaw the Trimble 4000 SEE receiver is working 24 h/day and data is transmitted to regional and global IGS centers. WUT group started to generate the improved GPS orbits for practical application.

2. On October 15-17, 1990 the first Baltic Sea Level GPS Campaign was performed. It consisted of 26 points at the tide gauge sites along the Baltic Sea coastline. The scientific goals of the project are: study of the sea level changes, land uplift investigation and connection of the levelling networks of the countries surrounding the Baltic Sea. The next campaign was carried out in July 1993. It comprise at least 30 stations located in 8 countries. The summary of the campaign and a status report on the data bank situation was presented during the meeting of the International Association of Geodesy Study Group in Stockholm and IAG General Meeting in Beijing, August 1993.

3. EXTENDED SAGET campaigns are follow-up actions of the Polish geodynamical Project SAGET. This project was initiated at the Institute of Geodesy and Geodetical Astronomy and the main objectives of this project is to create the precise geodetic frame for: studies on Teisseyre-Tornquist zone, investigation on the Carpathian Drogenic Belt etc. The last EXTENDED SAGET'93 campaign was carried out in summer 1993. It comprises about 40 GPS stations from at least 13 countries.

4. With the advent of GPS, the West European countries decided to use this technology to establish the new zero-order fundamental geodetic network. Political changes enabled East European countries to join this project and Poland engaged in extension of EUREF over its territory. The observational campaign was carried out in July 1992. After that, in 1993 the work was concentrated on a preprocessing, adjustment and computation of the final EUREF-POL solution. Final results were published in Warsaw in November 1993. The eleven points fundamental network for Poland is of the highest quality, standard deviation of the position is below 1 cm.

5. The Borowiec Laser Station operates continuously since May 1988. The actual status of the system is:

| | | |
|---|---|---|
| Laser transmitter | - | Nd: YAG |
| pulse energy | - | 100 mJ (green light) |
| pulse width | - | 100 ps |
| repetition rate | - | 10 Hz |
| divergence | - | 0.4 mrad |

The results obtained with the new laser transmitter confirm expected precision i.e. 3-5 cm. The station observed following satellites: Lageos 1 and 2, ERS-1, Starlette, Stella, Topex/Poseidon. The principal obligation is to provide the Lageos data to the International Earth Rotation Service, other activities are on request of interested agencies.

6. Another aspect of activity is the satellite altimetry. The goal is to prepare the methodology for processing of data for geophysical and oceanographical applications. For this purpose the collaboration with different institutions in Denmark, France, USA and European Space Agency is developed. Efforts are focused on processing of ERS-1 data for the Baltic Sea. The study includes Mean Sea Surface and gravity from altimetry. The future projects will be dedicated to processing of ERS-1 data from other satellite missions, e.g. TOPEX/Poseidon and ERS-2. The high quality of data and improvement of methodology provide the opportunity to identify oceanographical signals, like Sea Surface Topography and to monitor sea level changes that are the part of global change of our planet.

## III. REMOTE SENSING

This report gives account of most important topics in basic and applied research carried out in Poland during 1993 with the use of satellite, aerial and ground based remote sensing techniques.

1. Preparations to investigate trace gases and aerosols in the Earth's atmosphere with the use of the infrared spectrometer "Istok-1" from the board of the orbital station "Mir". The spectrometer will effectuate spectroscopic sounding of the atmosphere by registering emission spectra in the "limb" and "near-nadir" configuration. It will also register absorption spectra of the atmosphere by looking directly at the Sun. The spectral range 3.6 - 16 μm is divided into 64 channels with spectral resolution $\lambda/\Delta \approx 33$.

The Polish share of the scientific program comprises studies of the concentration and spatial distribution of trace gases. Construction work carried out in Poland comprises designing and building the digital VIS TV camera and tester "Vizir" coupled to the spectrometer. The experiment coordinated by the Institute of Physics of the Russian Academy of Sciences in Moskow engages groups of' Armenia, Czech Republic, Poland, Romania and Russia and will start in the fall of 1994.

2. Preparations to investigate the Martian atmosphere and the gas/dust torus presumably surrounding the planet along the orbit of its moon Phobos with the aid of an infrared Fourier spectrometer during the interplanetary mission "Mars-94". The spectrometer will register emission spectra in the bands 1.5 - 4.5 μm and 6 - 45 μm with spectral resolution 2 $cm^{-1}$. The Polish share of the scientific program currently comprises modelling of the concentration and its temporal and spatial changes for Martian atmospheric gases, of aerosols, dust and ice clouds during dust storms, of measurements of the gas/dust torus along the Phobos orbit. Construction work comprises designing and building of the power supply and tester comparable with similar systems ordered by CNES, ESA or NASA for various scientific experiments in space. The main coordinator of the project is Instituto di Fisica dello Spazio

Interplanetario CNR of Frascati and the project is realized by groups of France, Germany, Italy, Poland, Russia and Spain. The mission will be launched in October, 1994.

3. Preparatory phase of studies of the Earth's atmosphere with the aid of a Fourier spectrometer from the board of the satellite CESAR to be constructed by a team of the Central European initiative countries. The study phase is now being achieved, launch is planned for 1997.

4. Construction work on radiometers for ground truth measurements in the microwave frequency range serving to interpret SAR pictures from the board of the satellite ERS-1. Passive devices working at frequencies: 5,12,20 GHz will measure soil moisture content within projects on crop yield assessments based on ERS-1 data.

5. Research on dynamic soil moisture determination and yield forecasting. The main objective was to establish a system of assessment based on Landsat and NOAA satellite images which could enable forecasting of the production of forage from permanent grassland areas in Poland. It turned out that the quantitative results are different from the official information provided by the Central Statistical Office by a completely negligible error. Among subgoals, the creation of a digital map of land-use (comprising 24 land-use and land cover categories) based on interpretation of Landsat images is worth mentioning. The research was carried out under the UNDP/FAO POL/86/002 Project.

6. The research on moisture and evapotranspiration for crop yields assessment. Heterogeneous conditions of the vegetation cover connected closely to the moisture content were observed on SAR ERS-1 data for different growing stages during the seasons 1992-1993. The first results show that a correlation between microwave backscattering and soil moisture allows for assessment of crop yield. The research is carried out under ESA Pilot Project PP-PL-4.

7. Research on monitoring of degraded forests with the use of SAR ERS-1 data. Analysis of microwave images at test sites of spruce forests degraded by heavy air pollution in the Sudeten Mts and forests in Upper Silesia destroyed in 1992 by the longest known forest fire in Poland allowed for distinguishing some forest classes essential for plans of reestablishing the forest cover. The research was carried under the ESA Pilot Project PP-PL-3.

8. Several projects related to application of satellite and aerial images to geology and environmental protection were carried out. The main effort was put on the comprehensive analysis of geological data within GIS. In particular, the geodynamic map of Poland at 1: 500 000 and the map of tectonic discontinuities in Southern Poland at 1:200 000 were completed. Monitoring of sulphur mining in Tarnobrzeg area using remote sensing methods and GIS monitoring of phenomena in the Southern Baltic were carried out. The methodology of preparing geoenvironmental maps for local administration with the aid of remote sensing methods and GIS was elaborated. Among the international projects evaluation of ERS-1 data in combination with other

remote sensing data to analyse geological environmental problems in Central Sudeten Mts was prepared.

9. Studies of the Polish coastal zone by remote sensing methods with the use of the own receiving station for NOAA-AVHRR data were carried out. The main results are: dynamical classification of the western Polish coast, the map of the erosion hazard for the Hel peninsula coast, analysis of the sea surface phenomena in the Polish coastal zone.

10. Application of aerial remote sensing data to regional planning led to the inventory of space structure in the area of downtown Poznan. An aerial inventory of the hydrological state of the Vistula river from Oswiecim to Tczew for local water authorities was continued. A summary of research on aerial remote sensing of field draining systems is about to be published.

11. Training of students in Environmental Remote Sensing, especially in cartographic remote sensing and geographical photointerpretation is carried on. New methods and application of remote sensing make a part of postgraduate studies for school teachers of geography. Attempts to create a common forum for scientists and professionals developing and applying remote sensing methods for purposes of geographic environment led to two conferences: "Satellite remote-sensing in environmental studies" and "Geographical information systems in environmental studies".

## IV. SPACE BIOLOGY AND MEDICINE

The research in the field of space biology and medicine was concentrated on the effect of modified gravitation and hypoxy on the organism. Specifically the effect of acceleration with various onset rates was investigated aimed at the improvement of human tolerance to that flight physical factor.

Also the morphometric, ultrastructural research of satellite cells in muscle soleus in rats exposed to weightlessness during the biosatellites flights was conducted (see Postepy Astronautyki, 1992). Quantitative analysis has shown the degenerative changes in those cells when compared with the control ones.

Also the effect of weightlessness on the function of adrenal cells was found in cortical and medullary parts of adrenals of rats exposed to 13 days of space flight. These changes suggest the activation of these cells (paper in press).

Recently, the research of the hipoxy effect on the muscle system is carried out. This refers to morphometric ultrastructural analysis of the satellite cells in different rat muscles subjected to immobization stimulus.

PORTUGAL

[Original: English]

ANNUAL REPORT ON THE PORTUGUESE ACTIVITIES CONCERNING THE PEACEFUL USES OF OUTER SPACE

1. The year 1993 has witnessed the successful launch of the first Portuguese satellite. This experimental programme has several objectives, namely the conduct of a number of scientific experiments, and has given place to the definition of a plan for the launching of a network of 30 mini-satellites over the next decade. Meanwhile, significant efforts have been developed towards the establishment of a National Space Programme, formally created in 1993 by the Government, that will make major scientific and industrial contributions. During the last twelve months an important number of initiatives have been carried out, mainly focused on the development of national capabilities and expertise in specific areas of the peaceful use of space, as well as on the development of international cooperation activities with developing countries.

2. Among the areas that have been the subject of more intensive activity directly or closely related to international cooperation, the one related to the use of remotely sensed data captured by satellites has played a major role.

3. The following institutions have carried out activities through the systematic use of satellite data, offering in most of the cases academic and scientific training in their specialized areas:

- The National Meteorological Institute (INM), which has been long using, on a systematic basis, satellite imagery obtained from meteorological satellites for its weather watch and nowcasting, continued to develop projects for the application of remotely sensed data to agricultural, forestry and fishery activities;

- The Scientific Tropical Research Institute (IICT), with a wide experience and tradition in carrying out cooperation activities related to tropical research with developing countries, continued to carry out several projects on the use of GPS for geodesy purposes, and satellite imagery for the production of basic and thematic cartography;

- The National Institute of Industrial Engineering (INETI), and Geometral (associated in a consortium, SATCART) formed in 1987, continued to develop significant projects on the use of remotely sensed data and satellite image processing for several types of applications, namely the ones concerned with the field of agriculture and forestry, as well as software developments in remote sensing and GIS environments; the main users of these technologies are governmental and E.C. specialized agencies;

- The Group of Oceanography of the "Faculty of Sciences of Lisbon" continued to use remotely sensed data from meteorological satellites applied to sea studies, namely upwelling phenomena, identification of best suitable location for

fisheries exploitation, on a near-real-time basis, and sea water pollution characterization, namely modelling of oil spills drift in the ocean; it has been operating its own satellite receiving facility for NOAA/HRPT;

- The National Laboratory of Civil Engineering (LNEC) carried out projects using remotely sensed data on water resources and land use assessment for developing countries and dam reservoir inventory in Portugal;

- The National Geographic Information Center (CNIG), the coordinating agency of the National Geographic Information System (SNIG) continued to carry out the study and application of satellite imagery in the environmental characterization, land use assessment and agriculture applications, namely within the scope of several projects.

- The National Geographic Institute (IGC), as well as the Army Cartographic Institute (IGE) and Hydrographic Institute (IH) have continued their activities of specific projects aiming, for IGC and IGE, the use of satellite imagery in production and updating of cartographic maps and the use of GPS for geodesic purposes. The IH has used satellite imagery in the planning and conduct of oceanographic cruises aimed at collecting oceanographic data.

4. In June 1993 a major step was taken by the National Board for Scientific and Technologic Research and the National Center for Geographic Information, towards the establishment of a network of national remote sensing research groups and institutions, as part of the network of geo-referenced data, linking together cartographic data banks, satellite imagery and statistical and descriptive type of information related to specific locations in the country, within the scope of the National Geographic Information System (SNIG).

Indeed, the growing number of scientific and academic institutions that have been integrating remote sensing technology within their scientific and academic programmes, namely the Technical Engineering Institute and the Agronomics Engineering Institute (both from the Technical University of Lisbon), the Faculties of Sciences and Technology, and Social and Human Sciences (both from the New University of Lisbon), the Faculty of Sciences and Geographic Department (both from University of Lisbon), the University of Aveiro, the University of Porto, the University of Trás-Os-Montes e Alto Douro, and the University of Beira Interior, just to mention the most active ones, have substantially strengthened the expertise and the potential of such institutions regarding the cooperation with developing countries on the peaceful uses of outer space.

5. The implementation of cooperation activities with developing countries has been a high priority in a large number of institutions that are offering specific programmes for trainees from those countries in areas like meteorology, oceanography, hydrography, geodesy and cartography, soils, agriculture and forestry thematic cartography, natural resources management and environmental assessment.

Indeed, within the curricula of existing courses and training activities that are presently being offered in Portugal, the integration of specific training courses on the use of satellite imagery have already been implemented by the National Institute of Meteorology (INM), the Faculty of Sciences of the Lisbon University (both at the undergraduate level - in meteorology, solid earth geophysics and oceanography -, as well as in the Master of Science degree in oceanography, that includes a course on space oceanography), the Scientific Tropical Research Institute (IICT), the Geographic National Institute (IGC), the National Laboratory of Civil Engineering (LNEC), the SATCART Consortium and the National Geographic Information Center (CNIG). Besides these institutes, others such as the National Geographic Institute, the Army Geographic Institute and the Hydrographic Institute have been, and will continue to be, open to trainees from developing countries interested in geodesy, cartography, hydrography and oceanography, within their specialized programmes and agreements with similar institutions from Portuguese-speaking developing countries.

Besides the above mentioned educational and training activities, a significant expansion of the activities of cooperation with developing countries is being foreseen for the present decade, focused on the use of remotely sensed data captured from outer space. The opportunities for the development of such cooperation activities, directly related to the specific programmes of activity of the several Portuguese institutions referred above, that have been developing their experience and expertise on the use of remotely sensed data, will benefit in a most significant way from the National Space Programme created by the Government in 1993.

## SOUTH AFRICA

[Original: English]

### THE SOUTH AFRICAN COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH (CSIR): SATELLITE APPLICATIONS CENTRE (SAC)

The South African Council for Scientific and Industrial Research (CSIR), operates the Satellite Applications Centre (SAC) near Pretoria. The current activities and capabilities of the Centre fall into two main categories:

- ground station support to international satellite operating agencies;

- operation as a regional centre for the reception, processing and dissemination of satellite remote sensing data.

1. Ground Station Support

The SAC provides ground station support to the French national space agency, CNES, by performing the functions of Tracking, Telemetry and Control (TT&C) related both to satellites in orbit and to the critical launching operations.

The satellites involved in these operations are not limited to French satellites, and ground station support has in fact been provided for satellites operated by many other countries.

International cooperation in establishing standards for TT&C operations has led to a large degree of international compatibility in this domain, and the SAC adheres closely to these standards.

2. Satellite Remote Sensing

The SAC receives, processes and disseminates data from a number of earth observation satellites, including the meteorological/oceanographic series Meteosat and NOAA, and the ground observation satellites of the Landsat and SPOT series.

In the case of the polar orbiting satellites (NOAA, Landsat and SPOT), the coverage of the data includes southern Africa and the surrounding ocean up to a few degrees south of the equator, while the near-hemispherical coverage of Meteosat information includes the entire African continent.

The CSIR adheres to internationally accepted norms for the dissemination of the data, which is on a totally unrestricted and non-discriminatory basis. Currently, slightly more than half the data products (measured by value) are supplied to users outside the Republic of South Africa.

Data products include black-and-white and colour photographic imagery, and digital data recorded to international standards on a variety of magnetic recording media. Historical data can be provided from the SAC's extensive archives which in some cases date back to 1972.

Data from the NOAA and Meteosat series of satellites can be supplied in a form suitable for day and night cloud-cover mapping, sea surface temperature mapping, and studies of vegetation and drought conditions on a regional scale.

These factors relate to the environment which affects the well-being of all the peoples of the sub-continent, and are of critical importance to the monitoring and development of the regions scarce and often fragile renewable resources. Being of a regional or even global nature and insensitive to national boundaries, they constitute a domain in which great benefit can be derived from international cooperation. The SAC, and the CSIR as a whole, with its multi-disciplinary capabilities, are well positioned to make significant contributions in this regard.

Information from the Landsat and SPOT satellites are used in a wide variety of applications related to renewable and non-renewable resources. These include geo-exploration, agriculture and forestry, land use and vegetation studies, flooding and desertification, cartography and urban planning.

The proven, practical operational status of many of these applications, together with the rapid availability of satellite data over wide coverage areas independent of

physical access is of particular advantage for developing countries where conventional information gathering techniques may be handicapped by an adequate infrastructure.

The continued availability of this type of information over southern Africa can play a cardinal role in the identification, development and control of its natural resources and hence in the economic and social benefits that derive from this process. It is clear that international cooperation has a part to play, and is already doing so, as evidenced by the significant amount of remote sensing data currently supplied to numerous international development agencies active in the region.

## TURKEY

[Original: English]

### SPACE ACTIVITIES IN 1993

The year 1993 has been one of new initiatives and reorganization for space activities in Turkey.

Two major policy decisions were taken early in the year that will give a boost and new shape to the future of Space in Turkey:

On February 3rd 1993, the Supreme Council on Science and Technology, headed by the Prime Minister, declared "space" as one of five priority areas, the others being informatics, biotechnology, high-tech materials and nuclear energy. About a month prior to that decision, a national committee called UBITEK (Committee on Space Sciences and Technologies) was formed by TÜBITAK (Turkish Scientific and Technical Research Council) at the request of the State Planning Organization (SPO), with a mandate to draw up a policy paper and plans for development of Space Science and Technologies in Turkey. The Committee was also charged with an advisory role for the coordination of the various individual institutional "space" activities in the country.

With membership of over 30 representatives from various government departments and universities, UBITEK submitted a draft policy paper both to TÜBITAK and SPO for review, modification if necessary and submission to the Prime Minister's Office for approval to become an official government paper. Among the recommendations in the draft report is the establishment of a Turkish Space Agency in two to three years. Until then, TÜBITAK will form a special group to coordinate, plan and partially fund the space related research and development.

Some of the recommendations of the report are already under implementation in 1993. These include the following:

A decision to establish a national data center for remote sensing satellite data has been taken. Marmara Research Center at Gebze is charged with the planning and development of such a unit.

Courses on remote sensing (basics, data processing, instrumentation, applications) have been started. Intended for national attendance, they have proven to be quite popular and are expected to continue in an increasing manner in 1994 and beyond. Marmara Research Center, where the courses are held, intends to expand its training program to include foreign participation as well in the future.

A committee was formed to draw national standards for GIS (Geographic Information Systems). A first draft has already been issued and is under review.

A decision was taken to establish a national observatory and the site was chosen within an hours drive from the city of Antalya. Road construction and other infrastructure work is underway at the mountain site which is at an elevation of 2400 meters above sea level and away from optical and electromagnetic interference. An optical telescope of 60cm diameter donated by the Netherlands will be the first instrument at the site. Tataristan Autonomous Republic of the Russian Federation is also planning to place her 160 cm telescope for joint use. A two-meter size Turkish optical telescope is planned to follow.

Plans to set up a radio observatory at the same site are also underway. Agreement has been reached with the Institute of Radio Astronomy in Kharkov Ukraine to purchase a two meter dish to start radio observations. A 16 meter dish is also planned for possible completion in 1996.

Another major space activity in 1993 in Turkey has been the organization of the First Eurasian Symposium on Space Sciences and Technologies held at TÜBITAK's Marmara Research Center at Gebze on 25th through the 27th of October 1993. Some 250 scientists attended the symposium from Turkey, Russia, Belarussia, Ukraine, Azerbaijan, Kazakhstan, Uzbekistan, Turkmenistan, Armenia, Georgia, Northern Cyprus, Czech Republic and Bulgaria, as well as Germany, UK and the US. A wide spectrum of topics were covered in three parallel sessions from radio astronomy and ionospheric studies to remote sensing and instrumentation. A panel was held on the last day to discuss and identify areas and ways of regional cooperation in various space matters. It proved to be extremely fruitful.

Perhaps the most important event in 1993 in Turkey regarding space, is the launching of the first Turkish communications satellite TURKSAT. Originally scheduled for December 1993, the launch will now take place on the 21st of January 1994 from Kuru in the French Guyana. Built by the French company Aerospatiale, TURKSAT will be managed and operated by the owner, Turkish PTT. From its geostationary location at 42 degrees E, TURKSAT will link Turkey with both Europe and America to the West and Asia to the East.

International cooperation at both the regional and global levels stands as one of the core decisions of Turkish space policy, the results of which will be more apparent in the coming years.

# UKRAINE

[Original: English]

## NATIONAL SPACE PROGRAMME OF UKRAINE

General

1. The National Space Programme is prepared by the group of specialists of the National Space Agency, with the participant of the leading Ukrainian aerospace industry enterprises, research institutes of the Academy of Sciences and higher educational establishments.

1. 1. Based on our studies, the following documents have been prepared:

-- program documents and statements of the Supreme Soviet, President and Cabinet of Ministers, which cover the state activity on exploration and utilization of outer space; the proposals of the Academy of Sciences, Ministries, scientific, design and production organizations and enterprises of Ukraine;

-- analytical materials on the studies and evaluation of space programmes and achievements of other countries;

-- Ukraine's obligations resulting from the agreements reached within the framework of the intergovernmental space proqramme of the CIS.

1. 2. The main aims in the field of exploration and utilization of outer space in Ukraine are:

-- profound development of common directions in astronautics to satisfy the needs of the people and the whole of society;

-- research, development and implementation of the most profitable scientific findings in Ukraine;

-- setting up the national fund for existing fundamental and applied research, its effective use to receive highly profitable scientific and technical results;

-- organization of the perspective cooperation between leading research institutions of Ukraine involved in the fundamental and applied scientific studies and their foreign counterparts.

1. 3. These goals could be reached in 3 steps:

At the first step - the continuation of cooperation with the CIS countries based on mutual benefit and development of their space technologies in conformity with international standards, as well as their full scale ground space infrastructure.

At the second - appearance on the international space market with own production and proposals (integration of Ukraine as a space state to the international commonwealth).

At the third - matching the national interests in the field of space exploration and utilization and uniting efforts of space states to implement the projects of the world significance.

1. 4. The main directions of space activities in Ukraine are:

-- the space technology application for the space and telecommunications development, natural resources cost effective utilization, ecological monitoring, accident warning, search and rescue of planes and ships, production of unique materials in space;

-- the space facilities utilization to provide the scientific studies connected with the Earth, the Sun and in the other fields;

-- the space activity results application for the intensification of scientific and technical progress, implementation of space technologies into a national economy.

2. Priorities of space programme at the first step

2. 1. Creation of the national ground infrastructure for controlling space complexes and processing information received from space systems.

2. 2. Creation of the national aerospace transport system "Svitjaz" based on wide-fuselage aircraft and missiles.

2. 3. The improvement of "Zenit" launcher performances for launching the spacecraft on the geostationary orbits and setting up space modules.

2. 4. Development of the satellite systems for national economic and scientific purposes (communication, ecological monitoring, rational utilization of natural resources, the space industry and so on).

3. The main scientific and national economic directions of space programme

Proceeding from the principal regulations of space activities in Ukraine in the interests of development of own space facilities, participation in intergovernmental programmes of outer space exploration and utilization and international space activities, the main directions of national astronautics are as follows.

3. 1. Space communication and information systems

3. 1.1. Communication

There is a great necessity of the effective and reliable communication both internal and external in the Ukraine. Communication satellite systems largely provide the variety of information multichannellity, reliability and mobility of the communication. The

regional communication system, which covers all territories of Europe, Middle-East countries and Northern Africa, besides the space segment, is to have users and coordinate ground stations network. The service value of such system increases with its cheapness to users. This way it would be economically and technically profitable to establish the National space communication system of Ukraine that embodies state and commercial organizations and to augment it with the governmental, military, administrative and commercial communication. Before national space communication system is established, it would be more reasonable to lease channels of other countries systems, in the first place Russia and Canada.

3. 1.2. Navigation

Space navigation systems provide to determine precisely a location of moving objects (ship, planes and so on). However, reliable and high-speed observation system contains a large number of satellites in orbits that with small number of users could be expensive and therefore, it is necessary to orientate to the possession of moving objects of Ukraine, which requires navigation operations and the equipment. That would give the possibility to use Russian or American space navigation systems.

3. 1.3. Coordinate and time frequency support

The geopolitical status of Ukraine and its scientific and technical potential provide with the opportunity of orientation to the way of solving the problems of coordinate and time frequency support the science and production of Ukraine, which consists by stage of own infrastructure creation, development, production and utilization of coordinate and time frequency support elements.

With this, it is necessary to note the high level of conversion of this equipment, that is its working elements. The developments and technologies can be used in the most effective way in the interests of both civilian and defense production of Ukraine as well they can be exported to the world market. The main idea of this programme is the complex solving of issues both operative exact determination of object location and time frequency support as well as creation of unique coordinate and time support system proceeding from close relations of coordinate determination position methods and time frequency ones, also the tendency of making complexes and integration of elements from different systems. This corresponds to integral navigation facilities development and common time frequency according to CTS programme of Russia.

3. 1.4. Detection of objects suffering accidents

Creation of National emergency information satellite subsystem permits to elaborate the completed collect & data processing network of the following functions:

-- coordinate determination of moving and fixed objects through Doppler method, using "COSPAS" system ("Kurs");

-- transmission of limited information volume from any point of Earth surface to artificial Earth satellites (AES) from data collection platforms, that means sea belays,

emergency beacons, ecological control posts, ships, railway containers and other objects provided with monitoring equipment and information transmission through AES;

-- data receiving from AES "COSPAS-SARSAT" system on information receiving station located in Ukraine;

-- data initial treatment and its transmission to users through teletype, fax and modem;

-- integration to the national and international information computer network for information exchange and creation of proper data bases.

3. 2. Earth Observation

3. 2.1. Natural environment resources monitoring and ecology

Results of the Earth observation have shown their wide application in cartography, agriculture, melioration, geology, fishing, etc.

The efficiency of space technology in these areas increases mostly for the countries having large territories, big thinly populated regions with undeveloped ground structure.

The task of ecological control includes observation of the areas of radioactive, chemical, electromagnetic and thermal contamination, status of natural vegetation, water bodies, snow and ice covers, revealing of dangerous discharges of chemical and other harmful substances, conflagrations and emergency zones.

There are not many seismological active areas in Ukraine and they manifest themselves comparatively rarely, but harm, that can be avoided with early warning, turn out to be very substantial. Such works that have been started are subject of "Poperejennia" ("Warning") project. In spite of this, purely national system of earthquakes warning hardly would be financially profitable, that is why its further elaboration is reasonable in cooperation with the CIS countries (the Trans Caucases, Central Asia, Russia) and with Turkey, Iran, countries of Latin America, Japan, Australia with the head of Ukraine.

3. 2.2. Meteorology

The affinity of the space instruments to obtain meteorological information by its composition, performances and operating conditions to the space instruments for oceanographic tasks solving gives possibility of its placing in the spacecraft "Okean" ("Ocean") modification. Receiving and processing of information can be combined with the stations and centers of ecological oceanographic systems, with subsequent spreading through hydrometeorologic service channels

3. 3. Microgravity

Production of controlled-properties materials in conditions of microgravity promises good prospects, but to clear up several aspects of strictly physical, chemical and biological processes and to ensure its realization in the sufficient for recoupment amount, some period of theoretical and laboratory research, aim-minded natural experiments and scientific researches in the field of space facilities development should pass.

3. 4. Space biology and medicine

Space biology gets principally new information, which is extraordinary important to understand the modern biology basic problems:

-- the role of gravitation in formation and vital activity of the organisms on the Earth,

-- determination of mechanisms of microgravity influence in the molecular, cellular levels and in the level of the whole organism,

-- determination of damnific effects from the heavy charged particles space radiation.

Besides it constitutes a base to design the closed circuit ecological system of man's vitality maintenance during the long space flights, to predict such system operation reliability, to create effective space biological technology.

Ukraine is one of the principal centers for implementing of modern scientific research in cell biology in the space flight condition. The priority of the discovery of gravitational sensitiveness of a vegetal and bacterial cells, and establishment of the general mechanism for biological microgravity on the level of cell and organism belongs to Ukrainian scientists.

3. 5. Perspective space facilities

Taking into account the existing opportunities offered by the institutes of the Ukrainian Academy of Sciences, branch institutes and design organizations of Ukraine, it is necessary to develop the national scientific and technical potential to utilize more efficiently the space facilities, in particular:

-- methods and technologies for creation of extensive space systems (for example: space antenna);

-- new constructional, high temperature resistant materials with the use of national raw materials and industry;

-- the information technology and systems connected with the space technology;

-- facilities and systems for the Earth observation in the interests of the national economy and defense;

-- elements of space systems for ecological monitoring;

-- facilities for space defense systems.

3. 6. Space transportation systems

The scientific and production potential of rocket manufacturing in Ukraine allows at the same time to improve performances of the existing "Cyclone" and "Zenit" launchers and to develop a more perfect light and medium class launchers. It would be based on the military missiles and complexes, that are being deleted from the armament.

Creation of the national aerospace system based on wide-fuselage aircraft capable of delivering the payload of about 5-6 tons into the low orbit, permits fully to compensate for the absence of own launch site.

3. 7. Experimental base and ground infrastructure

The ground infrastructure consists of experimental base, flight control centers, receiving stations, information processing and distribution centers. Possessing considerable experimental base, a part of which is unique by its performances, the research and design institutions of Ukraine will support and develop it for the fundamental and applied research.

The most of a standard equipment may be used on the compensation basis for research and experimental works in the interests of countries-members of the CIS intergovernmental space programme.

It is proposed to use the modified space launch complex in Baykonur and Plesetsk as a ground complex for the servicing and launching of the spacecraft under the National Space Programme of Ukraine.

For the flight control center and complex of receiving and processing information it is proposed to use on the first step the network of ground and naval stations, lines of communication and centers, as it is fixed in the agreement.

3. 8. Space science

The near-earth space explorations tasks of studying the Sun, solar-terrestrial relations and astrophysical objects were formed even in the former USSR.

Based on scientific studies, technical facilities and prospects of their development, it is proposed to accept as a priority the task of investigating the Sun and solar-terrestrial relations with the aid of equipment, installed on the low- and middle-altitude artificial earth satellite, which ensures a high-precision orientation of the sensitive elements to the Sun or the Earth.

As to the astrophysical studies, if the Ukrainian scientific institutions are interested in such a research, to participate in the projects, which are worked out in Russia, carrying

out in parallel the design of the national system based on one of the stations for research of solar-terrestrial relations.

4. Staff training and scientific informational activity

Ukraine's higher education establishments, after necessary reorganization, can provide the specialists training and qualification improvement for engineering and control personnel corresponding to the requirements of the aerospace industry production.

The staff training is necessary for the organizations and enterprises, which takes part in the execution of the National Space Programme of Ukraine. It can be carried out on the faculties of the leading higher educational institutions in Kyiv, Kharkiv, L'viv, Odessa. It is necessary to develop the existing system of the staff training, to modernize the base of the school laboratories in higher education establishments, involved in the space programme. Within the framework of the intergovernmental agreements it is necessary t.o provide the possibility of students and postgraduates education (whole programme or by exchange) in the leading colleges of Russia and other countries according to the enterprises and organizations recommendations, which participate in the fulfillment of space technical problems. For the marketing of the national space product it is necessary:

-- To hold regular conferences of scientists, specialists of scientific and research organizations, designers and users of scientific and technical production of space industry.

-- To publish a periodical bulletin of National Space Agency of Ukraine.

-- To publish a scientific and technical magazine of NSAU "Space explorations in Ukraine" (6 times a year).

-- The National Space Agency must work out and establish the standards for the preparation of the new projects and programmes using the experience of leading space countries

5. International space activities of Ukraine

Ukraine, as a participant of the CIS agreement "On the common exploration and utilization of outer space" (Minsk, 30.12.91), takes part in the intergovernmental space programme and in the structures, providing the coordination of activity in terms of its fulfillment.

To achieve these aims, Ukraine is going to become a member of the European Space Agency, and is expanding its cooperation with other international organizations and other states.

Ukraine is a member of the UN Committee on the Peaceful Uses of Outer Space, International Astronautical Federation and International Telecommunication Union. The

membership in these organizations is used with the aim of defending national interests as well as for international cooperation in the field of exploration and utilization of outer space.

Enrolling Ukraine in the nearest future to the international programmes and activities in terms of "Mission to Planet Earth", "Mission from Planet Earth", "Human Space Flight", "Space Science" and "Space Education" will give the possibility to make its contribution to the efforts of world community in space field.

There are at present several universal space conventions and agreements, which determine the legal status of outer space utilization, the rights and responsibilities of countries that are involved in the space activity. The participation in the future development of space law will put Ukraine among the leading space states.